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S&T NEWS BULLETIN

THE LATEST IN SCIENCE AND TECHNOLOGY RESEARCH NEWS

FEATURE ARTICLES

Physicists show 'molecules' made of light may be possible

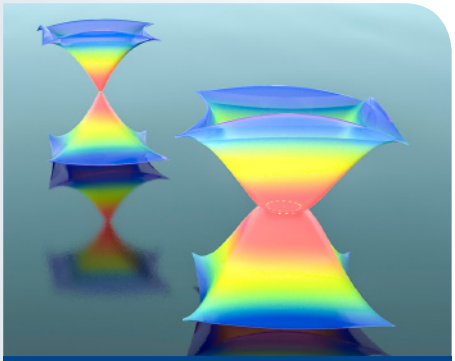
Science Daily, 10SEP2015

An international team of researchers (USA - University of Maryland, Harvard University, Argonne National Laboratory, Germany) has shown theoretically that by tweaking a few parameters of the binding process, photons could travel side by side, a specific distance from each other. The arrangement is akin to the way that two hydrogen atoms sit next to each other in a hydrogen molecule. TECHNICAL ARTICLE

Tags: Photonics, Featured Article

Physicists create exotic states that could lead to new kinds of sensors and optical devices

PhysOrg.com, 09SEP2015



A schematic drawing of how a ring of exceptional points (shown in white) can be spawned from a Dirac point (a dot), and thus change the dispersion from the normal, widely known conical shape into an exotic lantern-like shape. *Credit: MIT*

An international team of researchers (USA - MIT, Yale University, Japan, Singapore) has found that the Dirac cone can spawn a phenomenon described as a "ring of exceptional points." Around these points, opaque materials may seem more transparent, and light may be transmitted only in one direction. However, the practical usefulness of these properties is limited by absorption loss introduced in the materials. This phenomenon connects two fields of research in physics and may have applications in building powerful lasers, precise optical sensors, and other devices. TECHNICAL ARTICLE

Tags: Photonics, Featured Article

S&T NEWS ARTICLES

ADVANCED MATERIALS

Researchers give nanosheets local magnetic properties

Nanowerk, 10SEP2015

If you dissolve three-dimensional crystals in a special liquid, they spontaneously disintegrate into individual nanosheets. An international team of researchers (the Netherlands, USA - UC Irvine) has shown that based on the solution, various nanosheets can be introduced in micro-patterns on a substrate which form the starting point for the growth of thin magnetic layers. Depending on the type of nanosheet the structure of the magnetic film assumes a specific orientation, and thus determines the magnetism of the film at that location. TECHNICAL ARTICLE *Tags: Advanced materials, Materials science*

BIOTECHNOLOGY

'Lab-on-a-Chip' technology to cut costs of sophisticated tests for diseases and disorders

PhysOrg.com, 11SEP2015

The device, developed by researchers at Rutgers University, requires one-tenth of the chemicals used in a conventional multiplex immunoassay and the results are as sensitive and accurate as the standard benchtop assay. Additionally, the device automates much of the skilled labor involved in performing tests. It opens doors for new research because of its capability to perform complex analyses using 90 percent less sample fluid than needed in conventional tests.

Tags: Biotechnology

COMMUNICATIONS TECHNOLOGY

A2100 satellite is now reprogrammable in-flight

PhysOrg.com, 14SEP2015

The Lockheed Martin-built Hellas-Sat-4/SaudiGeoSat-1 will be one of the most powerful and agile communications satellites ever built. The payload brings unprecedented capability to the A2100 spacecraft. The technology will allow flexible bandwidth and frequency

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management for secure communications. That same technology can be used to dynamically reprogram satellites in-orbit and rapidly adjust communications networks.

Tags: Communications technology, Satellite technology

An even more versatile optical chip

Science Daily, 14SEP2015

An international team of researchers (Canada, UK, China, Australia) has recently designed a stable ultrafast laser based on an integrated microring resonator. The device produces photon pairs with orthogonal polarization while eliminating photons with undesirable frequencies. The wide variety of complex quantum states that can be generated by this device has the potential to offer a tremendous advantage for optical communication and applications such as signal processing and spectroscopy. TECHNICAL ARTICLE

Tags: Communications technology, Quantum science

Key component for terahertz wireless networks

Science Daily, 14SEP2015

Using a leaky-wave antenna based on a metal parallel-plate waveguide, an international team of researchers (USA - Rice University, Japan) demonstrated frequency-division multiplexing and demultiplexing over more than one octave of bandwidth. They showed that this device architecture offers a unique method for controlling the spectrum allocation, by variation of the waveguide plate separation. This strategy enables independent control of both the centre frequency and bandwidth of multiplexed terahertz channels. TECHNICAL ARTICLE

Tags: Communications technology

Research team 'activates' photonic chip for communication with light

PhysOrg.com, 14SEP2015

An international team of researchers (the Netherlands, Germany) has created a light chip which achieves a bandwidth of 495 THz. The spectrum created by the chip, called frequency comb, is not constant, but consists of about twelve million peaks that lie at exactly the same distance from each other. This makes it possible to not only increase the speed of optic communication techniques, but also to greatly improve the precision of atomic clocks, telescopes, and GPS equipment. TECHNICAL ARTICLE

Tags: Communications technology

System learns to distinguish words' phonetic components, without human annotation of training data

PhysOrg.com, 14SEP2015

Researchers at MIT have developed a new machine-learning system that can learn to distinguish spoken words and also learn to distinguish lower-level phonetic units, such as syllables and phonemes. The system is unsupervised, which means it acts directly on raw speech files. It doesn't depend on the laborious hand-annotation of its training data by human experts. Thus, it could prove much easier to extend to new sets of training data and new languages. TECHNICAL ARTICLE

Tags: Communications technology, Artificial intelligence

GOVERNMENT S&T

DOE releases new energy technology report

Science Magazine, 11SEP2015

Recently, the Department of Energy released the Quadrennial Technology Review which distills the views of more than 700 energy experts on promising research areas. They identified enormous underappreciated, and underexploited opportunities to conserve energy and increase supply in six sectors of the U.S. energy system, including the electric grid, buildings, and transportation.

Tags: Government S&T, DOE

IMAGING TECHNOLOGY

Defusing photobombs—researchers find ways to remove distractions from photos

PhysOrg.com, 11SEP2015

Researchers at Princeton University and their industry partners created detectors for a wide range of distracting elements which take away from the central focus of the photo. Besides creating task-specific detectors, they also created a weighting system that assigned values for different arrangements of colors and shapes in photos. They then created programs to train the software to identify and eliminate elements with the characteristics of distractors. TECHNICAL ARTICLE

Tags: Imaging technology, Artificial intelligence

INFORMATION TECHNOLOGY

New photonic chips could transform how online data is sent and stored

PhysOrg.com, 11SEP2015

Researchers working under the EU-funded IRIS (inter-grated reconfigurable silicon photonic based optical switch) project have developed photonic chips which use silicon as a miniaturised optical medium for transmitting and switching data at very high speeds. The optical inter-connection offered by the new chips means that huge amounts of data can be sent and received at the same time in a highly efficient manner.

Tags: Information technology

Research team demonstrates LEDs that use visible light to talk to each other and internet

PhysOrg.com, 11SEP2015

Researchers at IBM in Zurich modified off-the -shelf LED bulbs with a System-on-a-Chip running the Linux operating system, a visible light communication (VLC)

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"The greatest danger in modern technology isn't that machines will begin to think like people, but that people will begin to think like machines." —UNKNOWN

controller module with the protocol software and an additional power supply for the added electronics. They were able to create networks with a throughput of up to 1 kilobit per second. VLC-enabled bulbs could be used to broadcast beacons making it possible to detect the location of objects, linked into a network to route signal traffic or could be used to communicate with objects. TECHNICAL ARTICLE

Tags: Information technology, S&T Switzerland

Internet of Things can help US military cut costs, increase battlespace efficiency, report finds

Fierce Government IT, 10SEP2015

According to the Internet of Things in defense published by Deloitte University Press the military has been slow to adopt IoT applications because of complex technological and regulatory landscape. One way officials can more easily navigate the IoT arena is by using a value loop, which involves creation, communication, aggregation, analysis and action to discover the value in information.

Tags: Information technology

New limit to the Church-Turing thesis accounts for noisy systems

PhysOrg.com, 10SEP2015

While previously it has seemed that physical systems may violate the Church-Turing thesis, a conjecture that in a sense defines a computer, researchers at Princeton University show that this is not the case for noisy systems due to a new computing limit. The results could have implications for designing super-Turing computers, or "hypercomputers," which are hypothetical devices that outperform all existing computers. TECHNICAL ARTICLE

Tags: Information technology

Using magnetic permeability to store information

PhysOrg.com, 10SEP2015

A team of researchers in the US (US Army Research Laboratory, Corning, Inc., University of Nebraska, Naval Research Laboratory) reports that magnetic permeability—an intrinsic property of 'soft' ferromagnets—is not changed by exposure to a magnetic field, and therefore information stored by programming changes in the magnetic permeability of each memory bit will not be erased by exposure to magnetic fields. They also showed that the memory is less prone to degradation when exposed to gamma radiation. TECHNICAL ARTICLE

Tags: Information technology, Materials science

First new cache-coherence mechanism in 30 years

MIT News, 09SEP2015

In a multicore, the directory takes up a significant chunk of memory. At a recent conference, researchers at MIT unveiled the first fundamentally new approach to cache coherence in more than three decades. Whereas with existing techniques, the directory's memory allotment increases in direct proportion to the number of cores, with the new approach, it increases according to the logarithm of the number of cores. TECHNICAL ARTICLE

Tags: Information technology

MATERIALS SCIENCE

Silicon rich oxide based light emitting capacitors

Nanotechweb, 14SEP2015

Researchers in Mexico show that a high flow of carriers through preferential conductive paths created by silicon nanoparticles inside the silicon rich oxide film can produce a thermal effect by the high current. This thermal effect produces local structural changes, which alter the electrical and electro-optical behavior of the SRO films. TECHNICAL ARTICLE

Tags: Materials science

Crystal structure of metals can change at linear defects, which should affect the properties of the materials

PhysOrg.com, 11SEP2015

Researchers in Germany found that in manganese steel the alloy forms a different crystal structure at linear defects than is typical for the material. The individual crystal grains can be considered as a stack of individual atomic layers. Linear defects, or edge dislocations, occur when a layer remains incomplete so that the layers above and below it must take a step. The discovery has practical significance since the structure of steel depends on how malleable, rigid and ductile it is. TECHNICAL ARTICLE

Tags: Materials science, S&T Germany

Novel approaches for the development of photo-catalysts and solar energy conversion materials

Physics World, 11SEP2015

To enhance the catalytic reactivity of anatase and the efficiency of devices for solar energy conversion based on anatase, it is critical to gain in-depth understanding and control of the reactions taking place at the surface of this material down to the atomic level. An international team

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of researchers (Japan, Czech Republic, Spain, Germany) successfully identified the atoms and common defects existing at the most stable surface of the anatase form of titanium dioxide by characterizing it at the atomic scale with scanning probe microscopy. TECHNICAL ARTICLE

Tags: Materials science, Solar energy

MICROELECTRONICS

Curly nanowires catch more light to power nanoscale electronic circuits

Nanowerk, 11SEP2015

Researchers in Turkey have shown that the nanospring shape induces 23 percent more power output both in the broad spectrum range and at some desired single point (which can be engineered easily), and these make powering of more advanced nanosystems possible with a single nanospring-based photovoltaics system. Certain wavelengths of light will match up in just the right way with the dimensions of the nanowire, causing light to "resonate" or bounce around inside the wire. TECHNICAL ARTICLE

Tags: Microelectronics, Materials science

Featured Resource

Armed with Science

Armed with Science is a daily blog site for the Department of Defense that incorporates print, video, and social media assets over 50 scientific organizations across the Federal government. RSS

NEUROSCIENCE

Researchers erase memories in mice with a beam of light

Medical Express, 11SEP2015

An international team of researchers (Japan, USA - University of Connecticut, University of North Carolina) has developed a new device that allowed them to alter the spines on a neural dendrite in a mouse brain that was first modified naturally by an event that caused a memory to form. Altering the spine caused a learned memory to be forgotten. TECHNICAL ARTICLE

Tags: Neuroscience

PHOTONICS

An atomic laser capable of operating at a wavelength of 0.15 nanometers

Nanowerk, 14SEP2015

Researchers in Japan built their atomic laser based on copper atoms. They exposed the foil to two X-ray pulses of different energies: one pulse was tuned as a pump source and the other as a seed for the main laser beam. They found that using the pumped copper medium in combination with seeding greatly enhanced coherence and energy extraction efficiency. It produces a stable beam with a wavelength of 1.5 Ångström. The discovery could transform the fields of medicine, quantum optics and particle physics. TECHNICAL ARTICLE

Tags: Photonics, S&T Japan

Optoelectronics: Tapering off for efficiency

Science Daily, 11SEP2015

III-V silicon lasers are particularly attractive as on-chip light sources. To be used in applications, such lasers must tightly confine light to maximize the lasing efficiency and should effectively couple light with optical waveguides located under the laser. Researchers in Singapore have achieved efficient lasing through the smart control of light and light is tightly confined to the III-V semiconductor layer in which lasing occurs. Furthermore, both laser ends are tapered to facilitate the coupling of light with underlying silicon waveguides. TECHNICAL ARTICLE

Tags: Photonics

QUANTUM SCIENCE

First realization of an electric circuit with a magnetic insulator using spin waves

Science Daily, 14SEP2015

An international team of researchers (the Netherlands, France) has succeeded in using spin waves in an electric circuit by carefully designing the device geometry. This allowed them to make use of the spin waves that are already present in the material due to thermal fluctuations, which requires a much smaller disturbance of the system and hence enables the spin waves to be used in an electric circuit. A device based on spin waves could theoretically operate more efficiently than ordinary electronic circuits. TECHNICAL ARTICLE

Tags: Quantum science

Uniting classical and quantum mechanics: Breakthrough observation of Mott transition in a superconductor

Science Daily, 11SEP2015

An international team of researchers (the Netherlands, Italy, Russia, USA - Argonne National Laboratory, UK) has announced the observation of a dynamic Mott transition in a superconductor. The discovery illuminates the mysterious nature of the Mott transition. It could also shed light on non-equilibrium physics, which is poorly understood but governs most of what occurs in our world. The finding may also represent a step towards more efficient electronics based on the Mott transition. TECHNICAL ARTICLE

Tags: Quantum science, Government S&T

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First Demonstration of Photonic Intelligence

MIT Technology Review, 10SEP2015

Researchers in Japan point out that the laws of quantum mechanics are probabilistic, and so provide a natural environment for decision theory. They built an extraordinary decision-making device. The device is a photon gun and a single photon detector that uses the laws of physics to make decisions, rather than complex algorithms. The device raises the possibility that this kind of photonic intelligence could help make complex decisions. TECHNICAL ARTICLE

Tags: Quantum science, Mathematics, Photonics, S&T Japan

Ultrafast uncoupled magnetism in atoms

Nanowerk, 10SEP2015

Future computers will require a magnetic material which can be manipulated ultra-rapidly by breaking the strong magnetic coupling. An international team of researchers (Germany, Sweden, Czech Repblic) used light pulses shorter than picoseconds to excite metallic gadolinium and then monitored the spin dynamics of both spin moments with ultra-short, high-energy x-ray flashes. The spin dynamics they revealed showed that the strong coupling was broken within picoseconds and it remained uncoupled for almost 100 picoseconds. This will open up an exciting new area of research. TECHNICAL ARTICLE

Tags: Quantum science, Communications technology

Understanding of complex networks could help unify gravity and quantum mechanics

Science Daily, 10SEP2015

Several models have been proposed for how different quantum spaces are linked but most assume that the links between quantum spaces are fairly uniform. The new model proposed by an international team of researchers (UK, Germany), which applies ideas from the theory of complex networks, has found that some quantum spaces might actually include hubs. Calculations run with this model show that these spaces are described by well-known quantum Fermi-Dirac, and Bose-Einstein statistics indicating that they could be useful to physicists working on quantum gravity. TECHNICAL ARTICLE

Tags: Quantum science

Chip-based Quantum Key Distribution

arXiv, 02SEP2015

An international team of researchers (UK, Japan) reports low error rate, GHz clocked QKD operation of an InP transmitter chip and a SiOxNy receiver chip. They use the reconfigurability of these devices to demonstrate three important QKD protocols - BB84, Coherent One Way and Differential Phase Shift. These devices, when combined with integrated single photon detectors, satisfy the requirements at each of the levels of future QKD networks, from point-of-use through to backbone, and open the way to operation in existing and emerging classical communication networks. TECHNICAL ARTICLE

Tags: Quantum science, Communications technology

S&T POLICY

Russia developing underwater drone submarine to deliver megaton nuclear weapon

Next Big Future, 09SEP2015

The weapon is envisioned as an autonomous submarine strike vehicle armed with a nuclear warhead ranging in size to "tens" of megatons in yield. A blast created by a nuclear weapon that size would create massive damage over wide areas.

Tags: S&T policy, Military technology, S&T Russia

SCIENCE WITHOUT BORDERS

Researchers test speed of light with greater precision than before

PhysOrg.com, 14SEP2015

In an experiment, an international team of researchers (Germany, Australia) compared the extremely pure microwave frequency signals from two cryogenic sapphire oscillators against each other over the course of a year. The stringent testing also confirmed a core component of Einstein's theory of Relativity, 'Lorentz symmetry,' which predicts that the speed of light is the same in all directions. TECHNICAL ARTICLE

Tags: Science without borders

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